

**Summary of ICCR Source Work Group Meeting
September 1, 1998
Reciprocating Internal Combustion Engines WG Meeting**

I. Purpose

The main objectives of the meeting were the following:

- Reach consensus on submitting the WG Closure Items, including:
 - *Rich Burn Engine Definition White Paper
 - *Emissions Database White Paper
 - *Landfill/Digester Gas Above the Floor MACT White Paper
- Reach consensus on submitting WG Work in Progress Items, including:
 - *Pollution Prevention White Paper
 - *New Source MACT White Paper
 - *Definitions
 - *Catalyst Control Costs

II. Location and Date

The meeting was organized by the Environmental Protection Agency (EPA) and was held at the Days Inn in Research Triangle Park, North Carolina. The meeting took place on September 1, 1998.

III. Attendees

Meeting attendees included representatives of the OAQPS Emission Standards Division, industry, trade associations, universities, and state and local agencies. A complete list of attendees, with their affiliations, is included as Attachment I.

IV. Summary of Meeting

The meeting consisted of discussions between WG members on selected issues which are listed below. The order of the meeting followed the agenda provided in Attachment II. A bullet point summary of the meeting is presented as Attachment III.

The topics of discussion included the following:

- "Rich Burn Engine" Definition White Paper
- Emissions Database White Paper
- Landfill/Digester Gas Above the Floor MACT White Paper
- Pollution Prevention White Paper
- Definitions
- Catalyst Control Costs
- New Source MACT White Paper

"Rich Burn Engine" Definition White Paper

- Linda Coerr and Sam Clowney provided copies of an "August 31, 1998 - Alternative Proposal for Rich Burn White Paper" document for the WG. Copies of this document may be obtained by contacting Jennifer Snyder at 919-954-0033.
- Jim McDonald of Miratech Corporation joined the group for the discussion. Jim indicated that engines must be able to operate with less than 0.5% oxygen in the exhaust to use NSCR for NOx control. He indicated that for the majority of engines that operate with an exhaust oxygen content of up to 4%, an air to fuel ratio controller can be installed to bring the oxygen content down to 0.5%, and thus, NSCR can be installed and work properly, simultaneously reducing NOx, CO and HC. Jim suggested that in other cases, where engines cannot be brought down to the 0.5% oxygen content in the exhaust, NSCR theoretically will still work for the reduction of hydrocarbons. Jim stated that to date, he is unaware of any NSCR installed for the purpose of just CO and HC control. Jim indicated that this has not been done in the past because there have not been requirements for HC reduction, and the use of NSCR is more expensive than installing a CO catalyst, which would typically be installed on these engines.
- Sam Clowney argued that in his experience, oxygen content higher than 1% has burned up the catalysts, and in the "real world," using catalysts in this way is just not feasible. In addition, for some engines, an air to fuel ratio controller cannot bring the oxygen exhaust content to the required levels for NSCR to function properly.
- One WG member noted that to use NSCR for NOx control, the engines must be able to run reliably at 1% or less excess oxygen. For most cases, an air-to-fuel ratio controller is used to reliably operate the engines at this level.
- Jim McDonald, Bill Passie and Bob Stachowicz confirmed Sam's concerns regarding some older models of engines. They indicated that old Ingersoll Rand units are probably some rich burn engines on which an air to fuel ratio controller

will not function as required for NSCR application for the purpose of NO_x reduction.

- Don Price brought up the point that air to fuel ratio controllers should always be installed with NSCR, because exhaust oxygen content is never as stable as it should be without them. Compliance is much harder to achieve continuously without the air to fuel ratio controllers. Jim McDonald estimated that 500 out of 800 NSCR's operate with air to fuel controllers.
- Jim McDonald also pointed out that a catalyst manufacturer's definition of a rich burn engine is one that can achieve an exhaust oxygen content of less than 1%, typically 0.5%. This has been adopted because the application of NSCR will not work for NO_x reduction for engines with an exhaust oxygen content greater than 1%.
- Bill Passie stated that all new engines designed as rich burns should be NSCR-ready.
- Don Price stated that the definition should be based on 4% oxygen, since some engines will always be a problem. There will always be outliers. Mike Horowitz pointed out that the regulation does not have to require NSCR on those engines which cannot achieve an air to fuel ratio less than 1% oxygen. Mike's concern is that if the definition is based on 1%, then there will be many engines left out, which could be regulated in an achievable manner, i.e., with an air to fuel ratio controller that would bring the oxygen content down to <1%.
- Sam Clowney suggested that the definition should throw a wide enough loop to not miss any units that should be included, but the WG should not write a rule that is technologically unsound. Sam stated that the wider the range, the more likely there will be ones that cannot achieve the standard.
- Bill Passie pointed out that Caterpillar defines rich burn engines at <4% oxygen content in the exhaust.
- Brahim Richani passed out a copy of Waukesha's sketches of control devices. This is not available electronically, but copies may be requested from Brahim at 919-954-0033. He pointed out that the dual bed catalyst, which contains both an oxidation and a reduction step, and does not require <1% oxygen, seems ideal. Bob Stachowicz rebutted that this was an older technology, which is on its way to becoming obsolete, and does not work as well as its sketched out to be. It requires the engine to burn extremely rich in the first stage, and then extra air is injected for the oxidation step. The ratios do not need to be extremely precise for the technology to work.

- Bryan Willson stated that dual bed catalysts would not qualify for MACT floor, since there are not as many units in the existing population with those controls as units with NSCR. However, dual bed catalysts may be viable for above the floor MACT.
- Ed Torres proposed a definition which included the concept of oxygen content <4% AND compatible with NSCR technology. This is because it is highly likely that a NOx requirement will also have to be met.
- Don Price stated that the rule should be more inclusive rather than less, because there is always mass circumvention of the rule. The rule cannot be based on NSCR technology, because only 20% of the current population currently operates these. There should be alternatives to NSCR. Mike Horowitz argued that Ed's definition does not cover those "rich burns" that can still use oxidation catalysts.
- Jim McDonald stated that he could not think of a reason why SCR would not work chemically with oxygen contents below 7%, but that he had no experience with SCR on such engines. Jim surmised that this is due to high costs associated with SCR, and a three way catalyst would accomplish NOx reduction for lesser cost. For lean burn engines, Jim noted that SCR's are often if not always used in conjunction with CO catalysts because of the ammonia slip.
- Bob Stachowicz stated that the MACT floor for four stroke rich burn natural gas fired engines perhaps should have been based on "catalytic reduction" or "catalytic control" rather than "NSCR." Mike Milliet pointed out that it was verified by state regulators that "catalytic reduction" on "rich burn engines" were NSCR.
- Brahim Richani brought up the point of compliance; if the engine is classified by its oxygen content, and not by the manufacturer's original classification of the engine, then will continuous emissions monitoring be required?
- Sam Clowney stated that regulations were already in effect that required rich burn engines to run lean for NOx reduction. These engines cannot remain classified "rich" since they are operating lean of stoichiometry.
- Consensus on this document was not reached at this meeting. It was decided that Linda Coerr would revise the draft based on the discussion, and would e-mail it out on Wednesday, September 2, so that it could be discussed in a morning teleconference on Thursday, September 3.

Emissions Database White Paper

- Linda Coerr and Sam Clowney provided a revised draft of the

Emissions Database White Paper to the WG. Copies of this document may be obtained by contacting Jennifer Snyder at 919-954-0033.

- It was decided that a table would be added in conjunction with Table 3, to make it clear which pollutant emission estimates were made solely on non-detects and which ones were made with a mixture of detects and non-detects.
- Other minor revisions were made to the draft. It was decided that this document, once revised based on the comments made during this meeting, would be sent as a closure item from the RICE WG to the CC, to be submitted to EPA.

Landfill/Digester Gas Above the Floor MACT White Paper

- The draft of the Landfill/Digester Gas Above the Floor MACT White Paper was discussed by the WG. Minor revisions were made to the draft. It was decided that this document, once revised based on WG comments, would be sent as a closure item from the RICE WG to the CC, to be submitted to EPA.

Pollution Prevention White Paper

- The draft of the Pollution Prevention White Paper was discussed by the WG. Minor revisions were made to the draft. It was decided that this document, once revised based on WG comments, would be sent as a work in progress item from the RICE WG to the CC, to be submitted to EPA.

Definitions

- The draft definitions were discussed by the WG. It was decided that the format would change to reduce the number of sections to two, for the final submittal to the CC. The first section, "Definitions on Which Consensus Was Reached," will remain with minor changes. Mike Horowitz revised the definition of "stationary engine" based on that of "non-road engine," from 40 CFR 89.2. "Definitions on which Consensus Could Not Be Reached" will now be section 2, and the "suggested definitions" will be removed. Comments by WG members will remain in this section of the draft.
- It was decided that this document, once revised, will be sent to the CC to be submitted to EPA as a work in progress.

Catalyst Control Costs

- Minor changes were made to the Catalyst Control Cost Paper during the discussion. There was consensus on submitting this paper to the CC to be forwarded to EPA as a work in progress, contingent on the WG's suggested changes. Alpha-Gamma will make those changes and resend the file to the WG before the Thursday September 3 Teleconference.

New Source MACT White Paper

- The draft of the New Source MACT White Paper was discussed by the WG. Minor revisions were made to the draft. It was decided that this document, once revised based on WG comments, would be sent as a work in progress item from the RICE WG to the CC, to be submitted to EPA.

Next Meeting Issues

- The next meeting will be held by teleconference on Thursday, September 3, 1998. The call-in number is 919-541-4485. This meeting is scheduled from 11 a.m. to 2 p.m. The main topic of discussion will be the Rich Burn Engine White Paper.
- Linda Coerr and Alpha-Gamma will prepare presentations for the Closure and Work in Progress Items to be presented at the CC. A teleconference will be held during the week of September 7 to discuss the presentations. It was decided that Sam Clowney will present the Closure Items, and Don Dowdall will present the Works in Progress.

These minutes represent an accurate description of matters discussed and conclusions reached and include a copy of all reports received, issued or approved at the September 1, 1998 meeting of the Reciprocating Internal Combustion Engines WG.
Amanda Agnew

ATTACHMENT I

LIST OF ATTENDEES

Stationary Internal Combustion Engines Work Group Meeting
Research Triangle Park, NC
September 1, 1998
List of Attendees

Amanda Agnew	EPA OAQPS Emissions Standards Division
Sam Clowney	Tenneco Energy
Donald Dowdall	Engine Manufacturers Association
Bill Heater	Cooper Energy Services
Michael Horowitz	EPA Office of General Counsel
Jay Martin	Engine Research Ctr, Univ. of Wisconsin-Madison
Michael Milliet	Texaco E&P Inc.
Vick Newsom	Amoco Production Section
William Passie	Caterpillar, Inc.
Donald Price	Ventura County Air Pollution Control District
Brian Quil	U.S. Naval Facilities Engineering Service Ctr.
Bob Stachowicz	Waukesha Engine Division
Ed Torres	Orange County Sanitation District
Bill Walker	Alaska Department of Environmental Conservation
Bryan Willson	Colorado State University
Bob Whiteley	Englehard
Jan Connery	Eastern Research Group
Brahim Richani	Alpha-Gamma Technologies
Jennifer Snyder	Alpha-Gamma Technologies
Linda Coerr	Coerr Environmental
Mahesh Gundappa	Radian International
Jim McDonald	Miratech Corporation

ATTACHMENT II

AGENDA FOR THE SEPTEMBER 1, 1998 RICE WG MEETING

Tentative Agenda
Reciprocating Internal Combustion Engine Work Group
September 1, 1998 Work Group Meeting
Research Triangle Park, NC

8:00 - 8:15 Welcome, Meeting Goals and Agenda Review (A. Agnew and J. Connery)

MEETING GOALS:

1. Discuss WG's Closure Items
 - a) "Rich Burn Engine" Definition White Paper
 - b) Emissions Database White Paper
 - c) Landfill/Digester Gas Above the Floor MACT White Paper
2. Discuss WG's Work in Progress Items
 - a) Pollution Prevention White Paper
 - b) Definitions
 - c) Cost of Control Catalysts

8:15 - 9:30 "Rich Burn Engine" Definition White Paper - Sam Clowney
(Last draft dated August 27, 1998)

9:30 - 10:00 Emissions Database White Paper - Sam Clowney
(Last draft dated August 24, 1998)

10:00 - 10:15 BREAK

10:15 - 11:30 Landfill Gas / Digester Gas Above the Floor MACT White Paper - Ed Torres
(Last draft dated August 27, 1998)

11:30 - 12:00 Pollution Prevention White Paper - Don Dowdall
(Last draft dated August 27, 1998)

12:00 - 12:30 BREAK and WORKING LUNCH

12:30 - 1:30 Definitions - EPA
(Last draft August 27, 1998)

1:30 - 2:00 Cost of Catalyst Control - EPA
(Copies will be provided at the meeting)

2:00 - 2:15 BREAK

2:15 - 3:00 New Source MACT White Paper - Don Dowdall
(Last draft dated August 27, 1998)

3:00 - 3:15 Flash Minutes - EPA

3:15 ADJOURN

ATTACHMENT III
BULLET POINT SUMMARY

Summary of ICCR Source Work Group Meeting, September 1, 1998
Internal Combustion Engines Work Group Meeting
Days Inn, Research Triangle Park, NC

Decisions/Discussion

- Consensus on the following White Papers as *Closure Items*, contingent on discussed changes:
 - *Landfill Gas and Digester Gas
 - *Emissions Database White Paper.
- Consensus on the following White Papers as *Works in Progress*, contingent on discussed changes:
 - *Pollution Prevention
 - *Definitions
 - *Catalyst Control Costs
 - *New Source MACT.

Next Meeting

- The next meeting will be held by teleconference on Thursday, September 3, from 11 a.m. to 2 p.m. EST. The main topic of discussion will be the Rich Burn Engine White Paper. The call-in number is 919-541-4485.

Action Items

- RICE WG: Comments on Rich Burn Engine White Paper by COB Wednesday to Linda Coerr, AGTI and EPA, including alternate text or specific changes requested.
- Alpha-Gamma: Correct Definitions White Paper, e-mail to RICE WG.
- Alpha-Gamma: Correct Catalyst Control Costs White Paper, e-mail to RICE WG.
- Alpha-Gamma: E-mail docket number to RICE WG and upload the Docket Index on the TTN.
- Alpha-Gamma and Linda Coerr: Prepare CC Presentations for September 15-16 CC Meeting.
- Linda Coerr: Correct Emissions Database White Paper, e-mail to RICE WG.
- Don Dowdall: Correct Pollution Prevention White Paper, e-mail to RICE WG.
- Amanda Agnew: Set up teleconference regarding the CC Presentation for the week of September 7. Will include Alpha-Gamma, Linda Coerr, Sam Clowney, Don Dowdall, Ed Torres, and Mike Horowitz.
- Amanda Agnew: Check on changing language from “co-funding” to “leveraging resources.” Use language from the ICCR Document.
- Bill Walker and Don Dowdall: Revise New Source MACT White Paper, e-mail to RICE WG.
- Ed Torres: Correct Landfill Gas and Digester Gas White Paper, e-mail to RICE WG.